Improving exhaust emissions and fuel efficiency by subjecting dry fuel to a plurality of magnetic fields

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Abstract of **NZ 328438 (A)**

Fluid fuel such as petrol, gasoline and diesel can be treated by removing at least a part of the water from the fuel, and then subjecting it to one or more magnetic fields of field strength up to 4000 gauss. The magnetic fields may are provided by a plurality of magnets arranged in sequence with the north pole of one magnet facing the south pole of an adjacent magnet. The fuel is subjected to turbulent flow conditions while passing between each pair of adjacent magnets in succession. Figure 4 shows a magnetic treatment device similar to that disclosed in NZ 231876, but with the addition of a water separator (32). The water separator (32) has a conical body section (36) so as to cause fuel to flow outwardly towards the edge of the separator (32). At the edge of the separator the heavier water drops downwards and collects in a pool (38) in the base of body (24).; The fuel (39) is sucked upwardly along a torturous path through magnets (5a), (5b) and (5c) and out via outlet port (1) in the manner described in NZ 231876.

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COMPLETE SPECIFICATION

METHOD AND APPARATUS FOR TREATING FLUIDS

We, **FORREST SCIENTIFIC RESEARCH LIMITED**, a New Zealand company of Unit 12, Parkhead Court, 5 Western Hutt Road, Petone, New Zealand

hereby declare the invention, for which We pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:

PT0505336

This invention relates to methods of magnetically treating fuels such as diesel and gasoline. More particularly, although not exclusively, the present invention relates to a method of treating dry fuel.

The applicant's prior New Zealand Patent No. 231876 discloses an apparatus for inhibiting the growth of protista by passing a fluid through a magnetic field, the disclosure of which is incorporated by way of reference. The method and apparatus of that invention were understood to improve the treated fuel by inhibiting the growth of protista in fluids such as diesel where protista are known to grow. The method and apparatus were not seen to be particularly applicable to petrol as petrol is not a favourable environment to support protista growth. NZ231876 discloses the treatment of a fluid supplied directly from a storage tank. Such fuels often contain significant amounts of water.

Where fuel is stored in a vehicle fuel tank it is affected by electrostatic charges due to the earths magnetic field which, it is believed, may inhibit full atomisation of the fuel. There may be high protistal growth during storage which is only partially reduced by magnetic treatment prior to combustion.

It is an object of the present invention to provide an improved method and apparatus for treating fuels or to at least provide the public with a useful choice.

According to a first aspect of the invention there is provided a method of treating a fuel including water comprising:

removing at least part of the water from the fuel; and

subjecting the fuel to one or more magnetic field.

Preferably the fuel is subjected to a plurality of magnetic fields of field strengths up to 4000 gauss in rapid succession for at least one second. At least one pair of adjacent fields being of different field strength or of different field polarity. Preferably the magnetic fields are provided by a plurality of magnets arranged in sequence with the north pole of one magnet facing the south pole of an adjacent magnet. The fuel passing between each pair of adjacent magnets in succession. Preferably the fuel is

subjected to turbulent flow conditions while passing between adjacent pairs of magnets.

There is further provided an apparatus for treating a fuel comprising:

a separator for extracting water from the fuel; and

magnetic treatment means for subjecting fuel output by the separator to one or more magnetic field.

Preferably the magnetic treatment means subjects the fuel to a plurality of magnetic fields of different field strengths of different field polarity. The magnetic fields are preferably of a strength of up to 4,000 gauss, preferably up to 1200 gauss, more preferably 20 to 200 gauss. The fuel is preferably subjected to the magnetic fields in rapid succession for at least one second.

The magnetic fields are preferably provided by a plurality of magnets arranged in sequence with the north pole of one magnet facing the south pole of an adjacent magnet; the fuel passing between each pair of adjacent magnets in succession. The fuel is preferably subjected to turbulent flow conditions while passing between adjacent pairs of magnets.

The separator is preferably integrally formed as part of the apparatus. The separator preferably includes flow directing means which causes water to flow downwardly whilst fuel is directed upwardly and through the magnetic treatment means. The separator preferably comprises a substantially conical section including means for radially directing the fuel such that water flows downwardly from the outer edge of the separator whilst fuel is forced upwardly through the magnetic treatment means.

According to a preferred aspect of the invention there is provided a method of treating a fuel stored within a container comprising periodically extracting fuel from the container, subjecting the fuel to one or more magnetic field and returning the fuel to the container.

There is also provided an apparatus for treating a fluid comprising magnetic treatment means for subjecting the fuel to one or more magnetic fields;

pump means for circulating fuel from a container through the magnetic treatment means and back to the container; and

timer means for periodically activating the pump means to periodically recirculate fuel through said magnetic treatment means.

The invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1:shows a cross sectional view of the magnetic treatment means described in New Zealand Patent No. 231876.

Figure 2: shows a schematic horizontal section through the apparatus as shown in figure 1.

Figure 3:is a schematic view of the lines of flux around the magnet stack shown in figure 1.

Figure 4:shows a magnetic treatment apparatus incorporating a water separator.

Figure 5a: shows a bottom view of a separator according to an alternative embodiment.

Figure 5b:shows a side view of the separator shown in figure 5a.

Figure 6: shows a front view of an apparatus for periodically recirculating fuel through a magnetic treatment apparatus.

Figure 7:shows the top view of the apparatus shown in figure 6.

New Zealand patent No. 231876 describes a method and apparatus for inhibiting the growth of protista. the magnetic treatment disclosed therein was believed to inhibit protista growth and so was considered to only be of use in the treatment of fuels supporting protista growth. As petrol is not a suitable medium to support protista

growth it was not considered that the method of magnetic treatment would provide any advantage when treating petrol.

The applicants have surprisingly discovered that the apparatus of the invention produces significant reductions in vehicle emissions and engine efficiency when employed in the fuel system of a petrol driven vehicle. It has been found that employing a magnetic treatment device as shown in figures 1 and 2 (and described in NZ231876) in the fuel path of a petrol driven vehicle (a Mazda 323 engine) the improvements in exhaust emissions and fuel efficiency shown in table 1 may be achieved.

TABLE 1

Mazda 323 Emission Test with and without the device fitted									
		Hc		Co		Co_2		0_2	KW
Vehicle Speed	With	Without	With	Witho	With	Witho	With	Without	
Idle	252.75	282	1.05	2.05	13.7	13.3	0.71	0.56	
% change	-10.37			-48.3		2.9		21.1	
50kph	153.25	145	3.6	3.31	12.08	12.3	0.26	0.35	14
%change	5.68			8.76		1.78		25.7	
70kph	164.5	160.3	8.03	7.17	9.02	9.56	0.06	0.29	22
% change	2.55			10.7		-5.6		0.79	
100kph	122.6	129.7	6.5	6.41	10.45	10.5	0	0	32
% change	-5.47			1.4		-0.5			

The exact mechanism by which the magnetic treatment achieves these improvements is not known. It is, however, believed that the magnetic treatment affects the fuel molecules at an atomic level by breaking down bonds between the hydrocarbon chains; resulting in decreased density and therefore smaller droplets

during atomisation of the fuel within an engine, resulting in more complete combustion of the fuel. More complete combustion reduces emissions and increases the power that may be delivered by an internal combustion engine.

To date the apparatus disclosed in NZ231876 has mainly been employed in the treatment of diesel fuel. Diesel often contains a significant proportion of water. It has been found that by removing the water from the diesel fuel prior to magnetic treatment that improved magnetic treatment can be achieved. It is believed that the water inhibits or retards the magnetic treatment process.

This method may be performed by placing a water separator in the fuel line prior to a magnetic treatment device of the type shown in figure 1 or figure 2. It is, however, preferred that the water separator be integrated within the magnetic treatment device for economy, compactness and ease of installation.

Figure 4 shows a magnetic treatment device similar to the device shown in figure 1 and in which corresponding parts are given the same numbers as in figure 1. The magnetic treatment device and water separator are housed within a body 24 fastened to a head 22 via fastening means 30. Head 22 includes an inlet port 3 which supplies fuel via a non-return valve 31 to a water separator unit 32. Non return valve 31 comprises a ball 33 supported by a seat 34 which is drawn towards orifice 35 to prevent fluid flow out of inlet port 3.

Water separator 32 has a conical body section 36 so as to cause fuel to flow outwardly towards the edge of separator 32. At the edge of separator 32 the heavier water drops downwards and collects in a pool 38 in the base of body 24. Fuel 39 is sucked upwardly along a tortuous path through magnets 5a, 5b and 5c and out via outlet port 1 in the manner described in NZ231876.

The water separator shown in figure 4 can be effective in removing over 98% of water contained in fuel. As well as the beneficial effect of removing water from the fuel it has been found that improved magnetic treatment of the fuel is achieved. It is believed that water inhibits or retards the breaking down of bonds between hydrocarbon chains which results in improved atomisation.

An alternative water separator is shown in figures 5a and 5b. Conical body portion 40 has a central aperture 41 through which fuel is provided to the separator. Radially and circumferentially downwardly extending ribs 42 direct fuel in a radial and circumferential direction towards the outer edges of conical body 40, from where the fuel is sucked upwardly as in the embodiment shown in figure 4. Water drops from the separator and collects below (as in figure 4) where it may be removed via outlet 50. Table 2 shows the improved performance when water is removed from the fuel prior to magnetic treatment compared to the case when fuel including water is magnetically treated.

TABLE 2

Vehicle type	Without Unit	With Unit	Type of Measurement
Mitsubishi			
Canter	45	18	Hartridge Smoke Units
Volvo F 7	64.3	39.5	Hartridge Smoke Units
Hinco Econo	78.3	37.9	Hartridge Smoke Units
BMW 324	2.07	1.40	Roetmeter
Toyota Starlet	1.72	1.32	Roetmeter
Mercedes Truck	4.23	2.23	Roetmeter

It has been found that by removing water from fuel and passing the dry fuel through the magnetic field arrangement through a tortuous path under turbulent flow conditions, that increased power, decreased fuel consumption and reduced exhaust emissions can be achieved when operating an internal combustion engine.

Where fuel is stored in a fuel tank for an extended period, high rates of protista growth may occur. This may be only partly remedied by subsequent magnetic treatment. It has been found that by periodically recirculating fuel from a storage tank through a magnetic treatment device, without drying the fuel by extracting water, protistal growth can be limited and, if water is removed while magnetic conditioning occurs, future growth ceases or becomes insignificant. Figure 6 shows an apparatus for periodically recycling fuel from a storage tank. Fuel is supplied

from a storage tank to inlet 60 of a magnetic treatment unit 61 of the type shown in figure 4. Fluid output from magnetic treatment unit 61 may be supplied directly via line 62 to an internal combustion engine or via line 63 to pump 64. The output of pump 65 returns fuel to the storage tank. A valve 56 may optionally be provided to enable or disable flow via line 63.

Pump 64 may be activated by a timer 65 to periodically recirculate fuel from the storage tank via magnetic treatment unit 61 and pump 64 back to the storage tank. Alternatively, pump 64 may be responsive to a signal from a remote control device 67 to operate for a prescribed period.

It has been found that by recirculating fuel through a magnetic treatment unit 61 at regular intervals that protistal growth may be effectively limited. Table 3 illustrates the improved results achieved using the above recirculation system compared to the situation when the system is not fitted.

TABLE +3
DEBUG TRIAL #1: MICROBIOLOGICAL RESULTS

SAMPLE			UNIT #1: UNMAGNETISED					UNIT #2: MAGNETISED				
			FUNGI (COLONY FORMING UNITS PER LITRE)				BACTERIA CFU/l	FUNGI (COLONY FORMING UNITS PER LITRE)				BACTERIA CFU/l
0	DAY	TIME (HRS)	HORMOCORNIS RESINAE	PAECILOMYCE S VARIOTII	PENICILLIUM spp	TOTAL FUNGI	PSEUDOMONAS AERUGINOSA	HORMOCORNIS RESINAE	PAECILOMYCE S VARIOTII	PENICILLIUM spp	TOTAL FUNGI	PSEUDOMONAS AERUGINOSA
	0		430	930	330	1910	1000					
1	1	1.0	20	1000	805	1125	0	0	100	140	240	0
2	1	3.0	0	1000	0	1000	0	0	130	0	130	26
3	1	5.0	0	1000	95	1095	100	0	100	2	102	0
4	1	7.0	38	1000	0	1038	0	0	0	160	160	0
5	1	9.0	0	1000	78	1078	50	0	90	100	190	70
7	2	26.5	0	1000	30	1030	0	0	0	15	15	0
8	2	29.5	25	1000	0	1025	0	0	0	20	20	0
9	2	32.5	0	1000	15	1015	0	0	0	10	10	0
11	3	50.5	100	1000	0	1100	0	0	0	0	0	0
12	3	53.5	0	1000	0	1000	0	0	0	0	0	0
13	3	56.5	58	1000	35	1093	0	0	0	10	10	0
15	4	74.5	0	1000	0	1000	3	0	0	60	60	0
16	4	77.5	0	400	5	405	1	0	0	80	80	0
17	4	80.5	0	0	80	80	0	0	0	0	0	0
19	5	98.5	0	0	84	84	0	0	0	0	0	20
20	5	101.5	0	0	29	29	1	0	0	20	20	0
21	5	104.5	0	0	55	55	0	0	0	20	20	0
23	6	122.5	0	0	781	781	1	0	0	0	0	0
24	6	125.5	0	0	657	657	0	0	0	540	540	0
25	6	128.5	0	0	0	0	0	0	0	0	0	0
27	7	146.5	0	0	568	568	0	0	0	0	0	0
28	7	149.5	0	0	100	100	0	0	0	500	500	0
29	7	152.5	0	100	0	100	0	0	0	0	0	0
31	8	172.0	0	0	60	60	0	0	0	30	30	0
33	9	196.0	0	0	0	0	0	0	0	0	0	0
35	0	220.0	0	0	0	0	0	0	0	0	0	0
37	1	244.0	0	0	300	300	0	0	0	25	25	0
39	2	268.0	0	0	0	0	60	0	0	0	0	0
41	3	292.0	0	0	380	380	0	0	0	10	10	0
43	4	316.0	0	0	130	130	0	0	0	0	0	0
45	5	340.0	0	0	100	100	0	0	0	80	80	0

This recirculation method may find application for vehicles that are used periodically, such as boats. The remote control activation may be suitable for storage tanks located in remote areas.

It will thus be seen that the present invention provides a simple and inexpensive method of treating petrol to reduce emissions and enhance complete combustion of petrol.

There is also provided an improved method and apparatus for treating a fuel containing water to remove the water content and improve combustion of the fuel.

Finally, there is a method of controlling protistal growth in a fuel by periodically recycling a fuel stored in a storage tank through a magnetic treatment device.

Where in the foregoing description reference has been made to integers or components having known equivalents then such equivalents are herein incorporated as if individually set forth.

Although this invention has been described by way of example it is to be appreciated that improvements and/or modifications may be made thereto without departing from the scope of the invention defined in the appended claims.

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CLAIMS:

1. A method of treating a fuel including water comprising:
   (i) removing at least part of the water from the fuel; and
   (ii) subjecting the fuel to one or more magnetic fields after step (i).

2. A method as claimed in claim 1 wherein the fuel is subjected to a plurality of magnetic fields of field strengths up to 4000 gauss in rapid succession for at least one second.

3. A method as claimed in claim 1 or claim 2 wherein the fuel is subjected to at least one pair of adjacent fields of different field strength or of different field polarity.

4. A method as claimed in claim 3 wherein the magnetic fields are provided by a plurality of magnets arranged in sequence with the north pole of one magnet facing the south pole of an adjacent magnet.

5. A method as claimed in claim 4 wherein the fuel passes between each pair of adjacent magnets in succession.

6. A method as claimed in claim 5 wherein the fuel is subjected to turbulent flow conditions while passing between adjacent pairs of magnets.

7. An apparatus for treating a fuel comprising:
   a separator for extracting water from the fuel; and
   magnetic treatment means for subjecting fuel output by the separator to one or more magnetic field.

8. An apparatus as claimed in claim 7 wherein the magnetic treatment means subjects the fuel to a plurality of magnetic fields of different field strengths of different field polarity.

9. An apparatus as claimed in claim 8 wherein the magnetic fields are of a strength of less than 4000 gauss.

10. An apparatus as claimed in claim 9 wherein the magnetic fields are of a strength of less than 1200 gauss.

11. An apparatus as claimed in claim 10 wherein the magnetic fields are of a strength of 20 to 200 gauss.

12. An apparatus as claimed in any one of claims 7 to 11 where the fuel is subjected to the magnetic fields in rapid succession for at least one second.

13. An apparatus as claimed in any of claims 7 to 12 wherein the magnetic fields are provided by a plurality of magnets arranged in a sequence with a north pole of one magnet facing the south pole of an adjacent magnet arranged so that the fuel passes between each pair of adjacent magnets in succession.

14. An apparatus as claimed in claim 13 wherein the arrangement is such that the fuel is subjected to turbulent flow conditions whilst passing between adjacent pairs of magnets.

15. An apparatus as claimed in any one of claims 7 to 14 wherein the separator is integrally formed as part of the apparatus.

16. An apparatus as claimed in any one of claims 7 to 15 wherein the separator includes flow directing means which causes water to flow downwardly whilst fuel is directly upwardly and through the magnetic treatment means.

17. An apparatus as claimed in claim 16 wherein the separator comprises a substantially conical section including means for radially directing the fuel such that water flows downwardly from the outer edge of the separator whilst fuel is forced upwardly through the magnetic treatment means.

18. Apparatus substantially as described herein with reference to Figure 4 or 5a-5b of the drawings.

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19. A method of treating a fuel including water as claimed in claim 1 substantially as described herein.

20. A method according to any of claims 1 to 6, wherein the fuel is a fluid fuel.

21. A method according to claim 20, wherein the fuel is diesel, gasoline or petrol.

ABSTRACT

In a first aspect petrol is treated by subjecting it to a plurality of magnetic fields of field strength up to 4000 gauss in rapid succession. This treatment is believed to improve vehicle performance due to improved atomisation of the fuel.

In the second aspect a fuel is treated by removing water from the fuel and then subjecting the fuel to one or more magnetic field. Removal of water from the fuel prior to magnetic treatment results in improved engine performance.

In a third aspect fuel stored within a container is periodically circulated through a magnetic treatment apparatus by a pump under the operation of a timer.

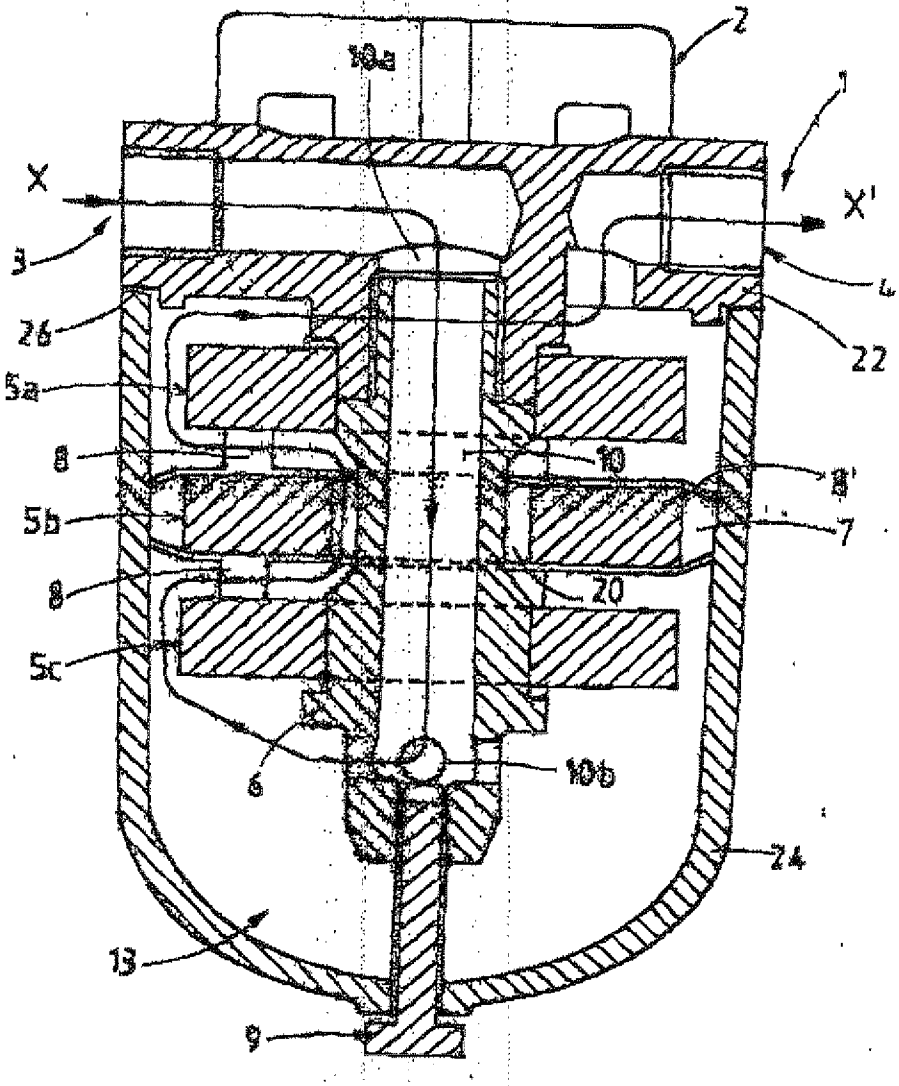

FIG.1

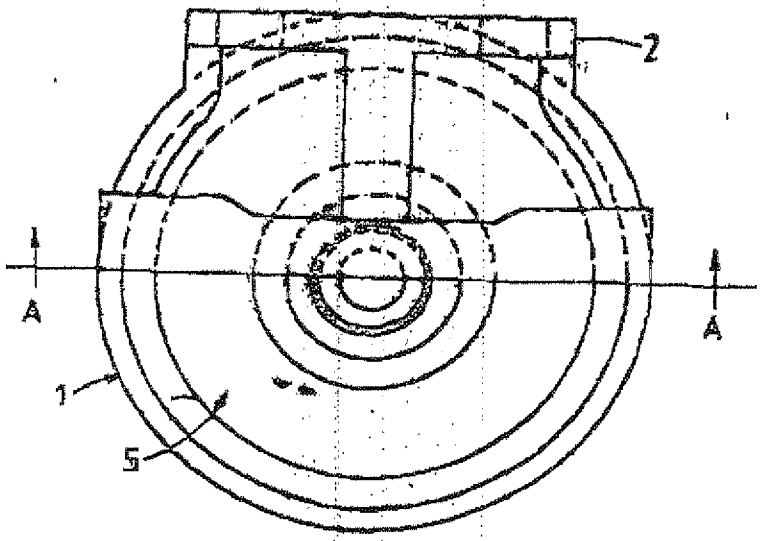

FIG.2

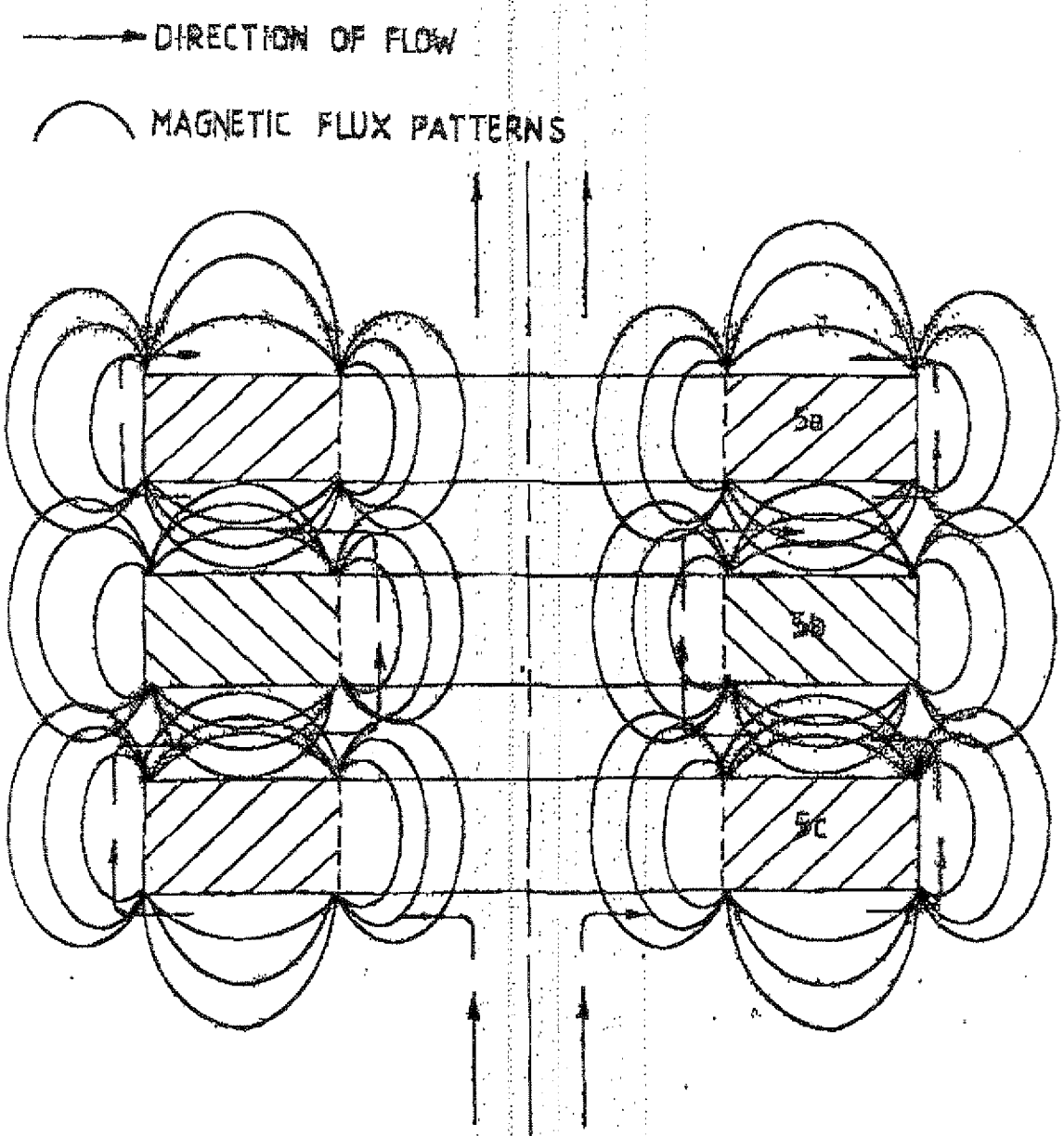

FIG.3

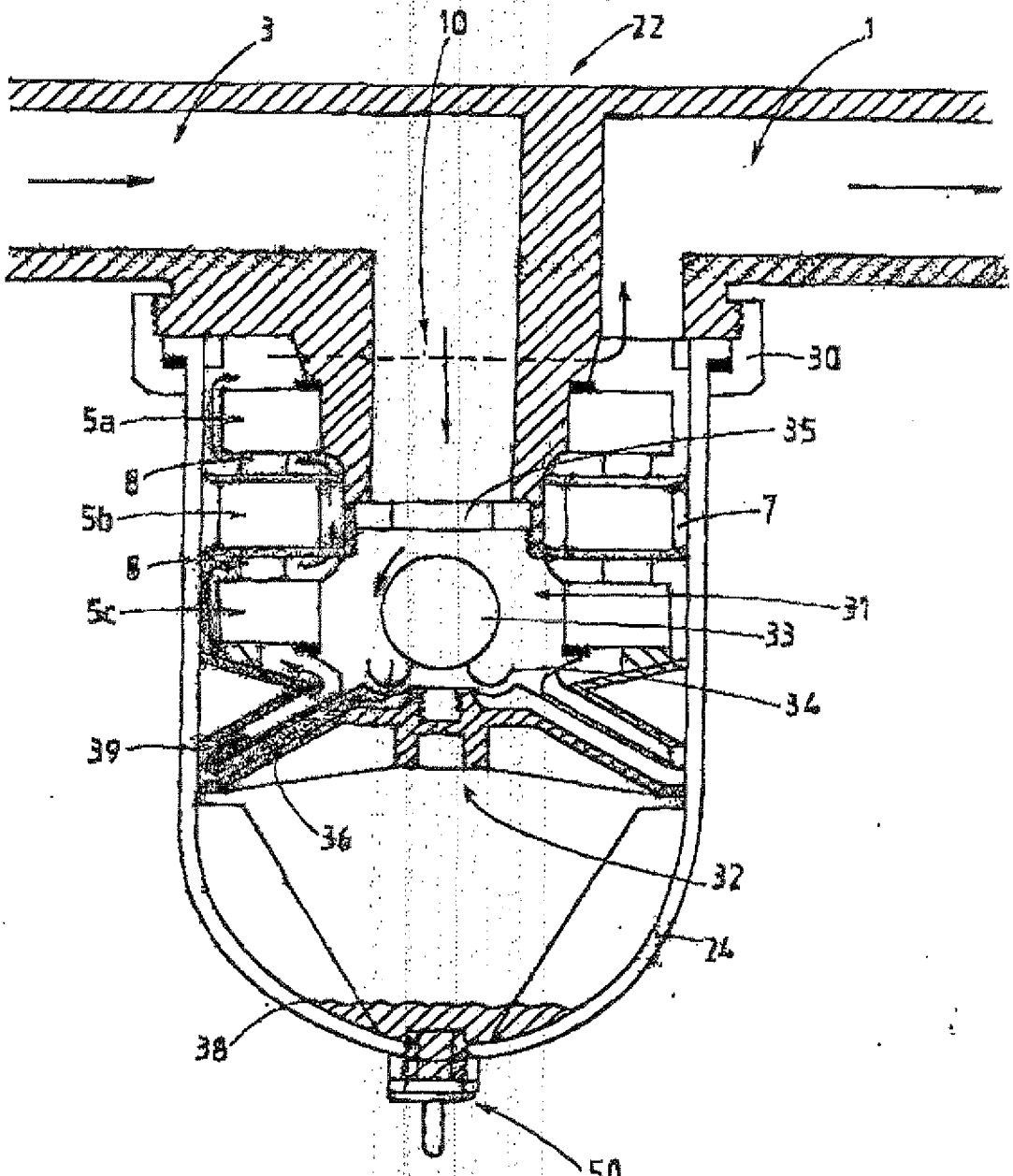

FIG.4

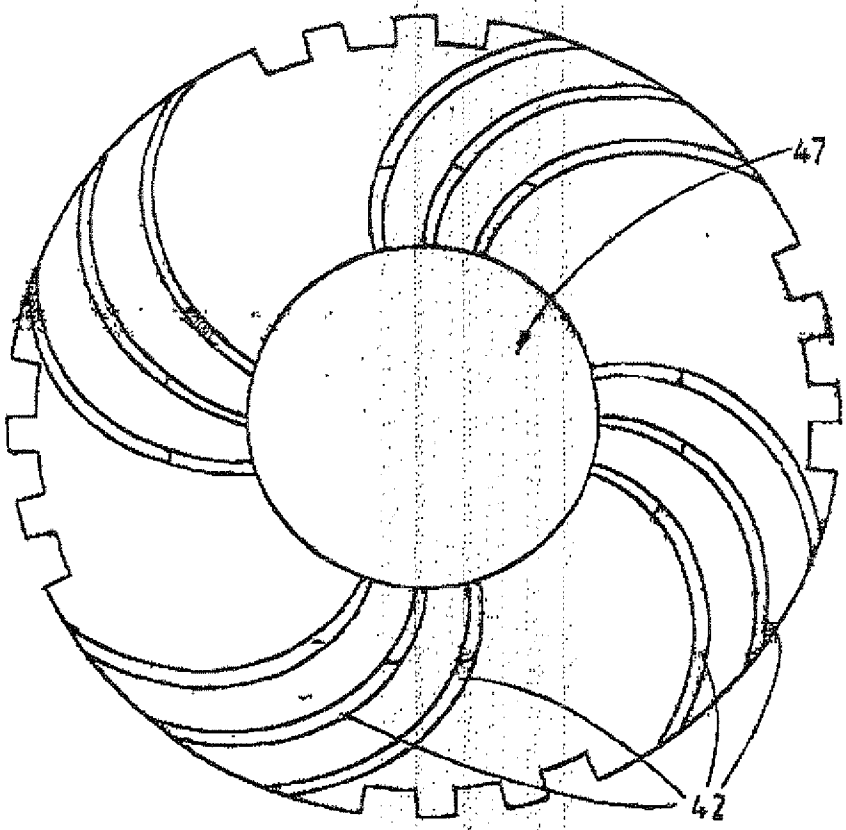

FIG. 5a

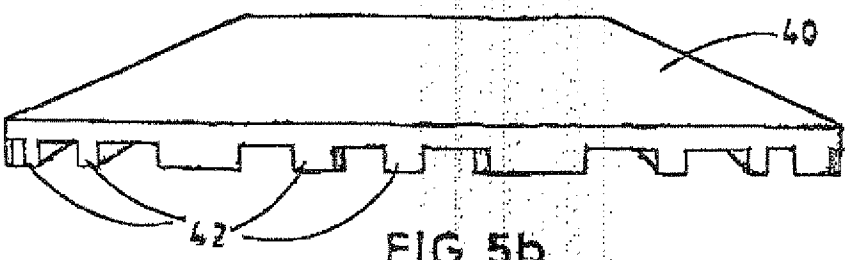

FIG. 5b

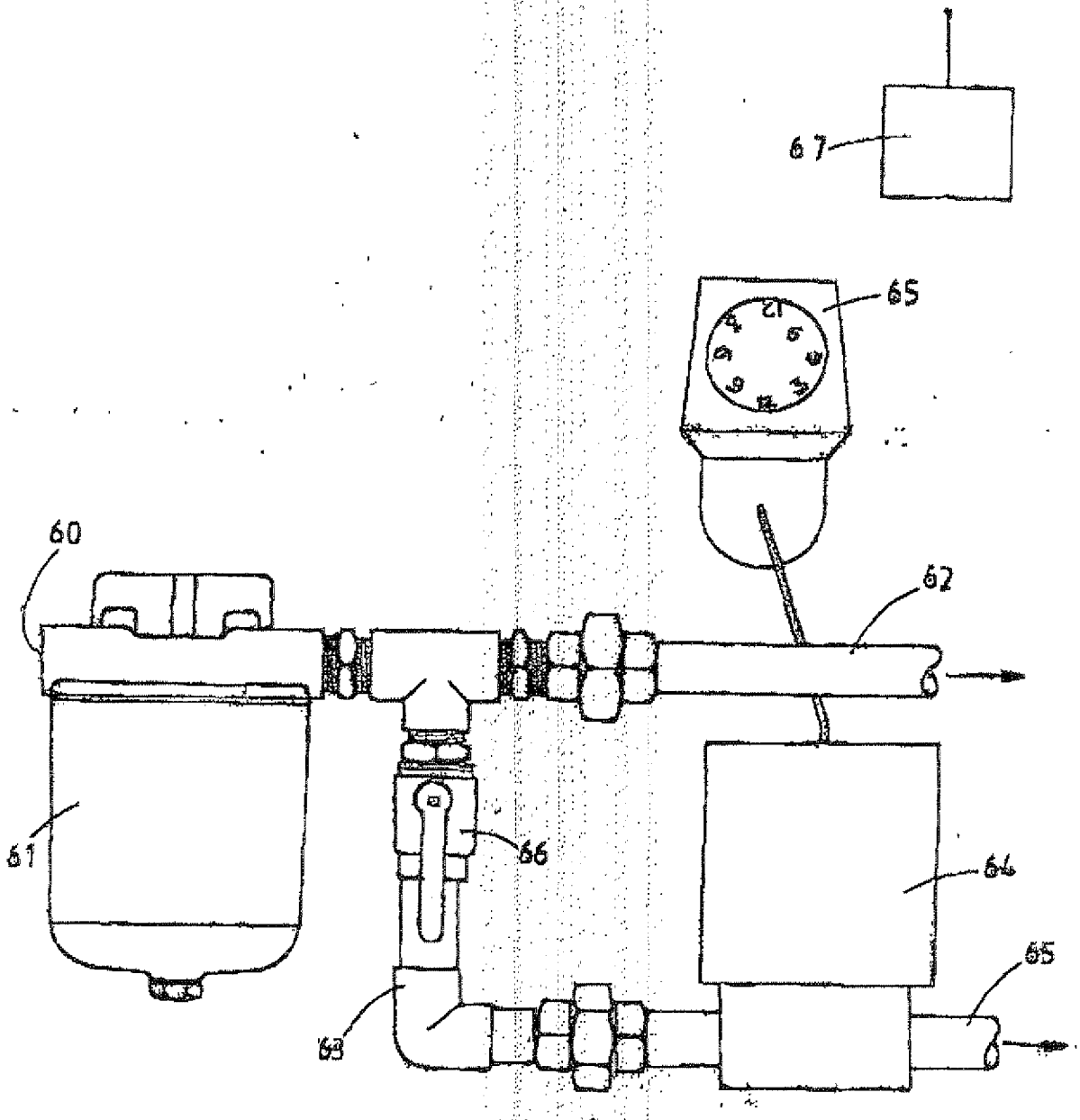

FIG. 6

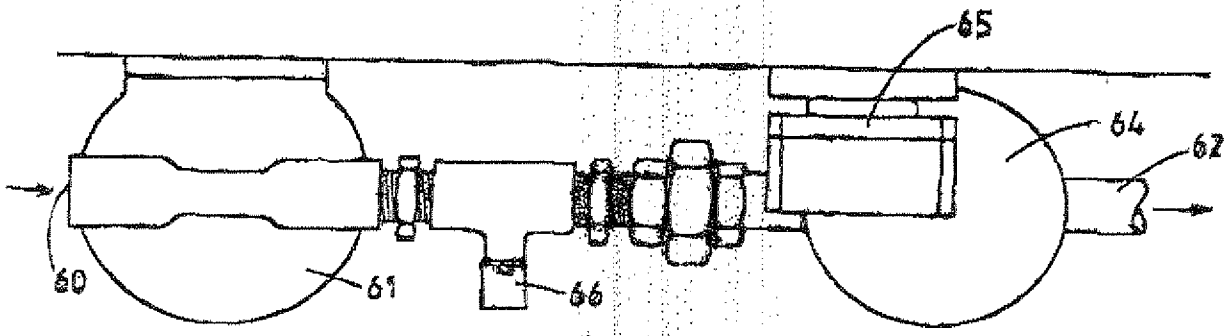

FIG. 7